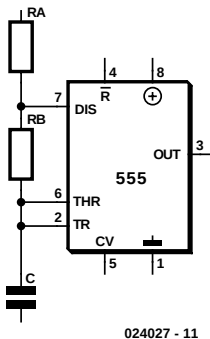


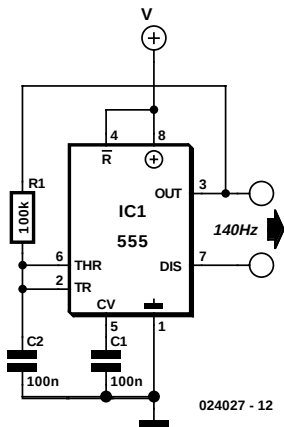
# Phantasia on a 555 Theme

# 038

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The 555 timer chip is older than many Elektor readers and has been used in numerous configurations. The suggestion presented here has not been seen elsewhere by the author and has some interesting features.

The configuration for which the device was designed is the well-known ' $R_A-R_B-C$ ' one that uses the internal discharge transistor to discharge the capacitor once it has reached 2/3rd of the supply voltage, see **Figure 1**. The author has often used the simpler arrangement where a single (usually variable or preset) resistor R1 charges and discharges capacitor C2 from the output pin — see Figure 2. This leaves the discharge transistor free and produces a (nearly) 50:50 duty cycle that does

not vary with frequency. Note that only CMOS 555s like the 7555 and TLC555 achieve exactly 50:50 duty cycle — the standard 555 does 48% low, 52% high.

The main output of the 555 is shown much simplified in **Figure 3**. The upper Darlington pair arrangement means that the output voltage can never reach the full supply voltage and (in the standard 555) will always be about 1.5 V below this when the output is in the high state.

The discharge transistor at pin 7 has no collector connection to V+ and can function as an open-collector switch only. This transistor can be used to switch current through a load. The open-collector arrangement has some unexpected features:

1. The load can be resistive, an LED(s) (with resistor), an inductor or transformer (do not forget a back-EMF suppressor diode when connecting inductive loads).
2. The load can be supplied from a voltage higher or lower than the timer chip, up to the limiting voltage of the 555 (usually 15 or 17 V, but always stay below 18 V).
3. The load will have no effect on the frequency or duty cycle

of oscillation (this also applies to the standard configuration).

4. A single resistor changes the frequency but the waveform retains a (nearly) 1:1 mark/space ratio. The frequency equals  $1.44 / RC$  [Hz].
5. The transistor current will limit at about 200 mA. At 100 mA the transistor drops about 1 V. Since the standard 555 is spec'd to 650 mW dissipation, allowing a safety margin of 25%, the load can be current driven to about  $500 \text{ mW} / 200 \text{ mA} = 2.5 \text{ V}$ . Note that the CMOS version can only sink 100 mA and source 10 mA.

